13.4.2.25.6.2 Vacant Code — When a 6-digit code is active but is not assigned to any customer on that code.

13.4.2.25.6.3 Non-Participating Group and unavailable Network Resource — should be identified in the LARG (LIDB Access Routing Guide) so MCIm does not pay access for queries that will be denied in LIDB.

13.4.3 **Interface Requirements**

ILEC shall offer LIDB in accordance with the requirements of this subsection 13.4.3.

13.4.3.1 The interface to LIDB shall be in accordance with the technical reference in Section 13.7.3.

13.4.3.2 The CCS interface to LIDB shall be the standard interface described in Section 13.7.3.

13.4.3.3 The LIDB Data Base interpretation of the ANSI-TCAP messages shall comply with the technical reference in Section 13.7.4. Global Title Translation shall be maintained in the signaling network in order to support signaling network routing to the LIDB.

13.5 **Toll Free Number Database**

The Toll Free Number Database is a SCP that provides functionality necessary for toll free (e.g., 800 and 888) number services by providing routing information and additional so-called vertical features during call set-up in response to queries from SSPs. This Subsection 13.5 supplements the requirements of Subsection 13.2 and 13.7. ILEC shall provide the Toll Free Number Database in accordance with the following:

13.5.1 **Technical Requirements**

13.5.1.1 ILEC shall make the ILEC Toll Free Number Database available for MCIm to query with a toll-free number and originating information.

13.5.1.2 The Toll Free Number Database shall return carrier identification and, where applicable, the queried toll free

number, translated numbers and instructions as it would in response to a query from a ILEC switch.

13.5.1.3 The SCP shall also provide, at MCIm's option, such additional feature as described in SR-TSV-002275 (BOC Notes on the ILEC Networks, SR-TSV-002275, Issue 2, (Bellcore, April 1994)) as are available to ILEC. These may include but are not limited to:

13.5.1.3.1 Network Management;

13.5.1.3.2 Customer Sample Collection; and

13.5.1.3.3 Service Maintenance.

13.5.2 **Interface Requirements**

The signaling interface between the MCIm or other local switch and the Toll-Free Number database shall use the TCAP protocol as specified in the technical reference in Section 13.7.1, together with the signaling network interface as specified in the technical reference in Sections 13.7.2 and 13.7.6.

13.6 **Automatic Location Identification/Data Management System (ALI/DMS)**

The ALI/DMS Database contains customer information (including name, address, telephone information, and sometimes special information from the local service provider or customer) used to determine to which Public Safety Answering Point (PSAP) to route the call. The ALI/DMS database is used to provide more routing flexibility for E911 calls than Basic 911. This Subsection 13.6 supplements the requirements of Subsection 13.7.2 and 13.7.6. ILEC shall provide the Emergency Services Database in accordance with the following:

13.6.1 **Technical Requirements**

13.6.1.1 ILEC shall offer MCIm a data link to the ALI/DMS database or permit MCIm to provide its own data link to the ALI/DMS database.

ILEC shall provide error reports from the ALI/DMS data base to MCIm immediately after MCIm inputs information into the ALI/DMS data base. Alternately, MCIm may utilize ILEC, to

enter customer information into the data base on a demand basis, and validate customer information on a demand basis.

13.6.1.2 The ALI/DMS database shall contain the following customer information:

13.6.1.2.1 Name;

13.6.1.2.2 Address;

13.6.1.2.3 Telephone number; and

13.6.1.2.4 Other information as appropriate (e.g., whether a customer is blind or deaf or has another disability).

13.6.1.3 When ILEC is responsible for administering the ALI/DMS database in its entirety, ported number NXXs entries for the ported numbers should be maintained unless MCIm requests otherwise and shall be updated if MCIm requests.

13.6.1.4 When Remote Call Forwarding (RCF) is used to provide number portability to the local customer and a remark or other appropriate field information is available in the database, the shadow or "forwarded-to" number and an indication that the number is ported shall be added to the customer record.

13.6.1.5 If ILEC is responsible for configuring PSAP features (for cases when the PSAP or ILEC supports an ISDN interface) it shall ensure that CLASS Automatic Recall (Call Return) is not used to call back to the ported number.

13.6.2 **Interface Requirements**

13.6.2.1 The interface between the E911 Switch or Tandem and the ALI/DMS database for MCIm customers shall meet industry standards.

13.7 SCPs/Databases shall be equal to or better than all of the requirements for SCPs/Databases set forth in the following technical references:

13.7.1 GR-246-CORE, Bell Communications Research Specification of Signaling System Number 7, ISSUE 1 (Bellcore, December 199);

13.7.2 GR-1432-CORE, CCS Network Interface Specification (CCSNIS) Supporting Signaling Connection Control Part (SCCP) and Transaction Capabilities Application Part (TCAP). (Bellcore, March 1994);

13.7.3 GR-954-CORE, CCS Network Interface Specification (CCSNIS) Supporting Line Information Database (LIDB) Service 6, Issue 1, Rev. 1 (Bellcore, October 1995);

13.7.4 GR-1149-CORE, OSSGR Section 10: System Interfaces, Issue 1 (Bellcore, October 1995) (Replaces TR-NWT-001149);

13.7.5 GR-1158-CORE, OSSGR Section 22.3: Line Information Database 6, Issue (Bellcore, October 1995)

13.7.6 GR-1428-CORE, CCS Network Interface Specification (CCSNIS) Supporting Toll Free Service (Bellcore, May 1995); and

13.7.7 "Bellcore Special Report SR-TSV-002275, IBOC Notes on the LEC Networks - Signaling".)

13.8 **Service Creation Environment and Service Management System (SCE/SMS) Advanced Intelligent Network (AIN) Access**

13.8.1 SCE/SMS AIN Access shall provide MCIm the ability to create service applications in the ILEC SCE and deploy those applications via the ILEC SMS to the ILEC SCP. This interconnection arrangement shall provide MCIm access to the ILEC development environment and administrative system in a manner at least at parity with ILEC's ability to deliver its own AIN-based services. SCE/SMS AIN Access is the provisioning of AIN triggers in a ILEC local switch, development of service applications within the ILEC Service Creation Environment, and deployment of service applications via the ILEC Service Management System. See Figure 7 below.

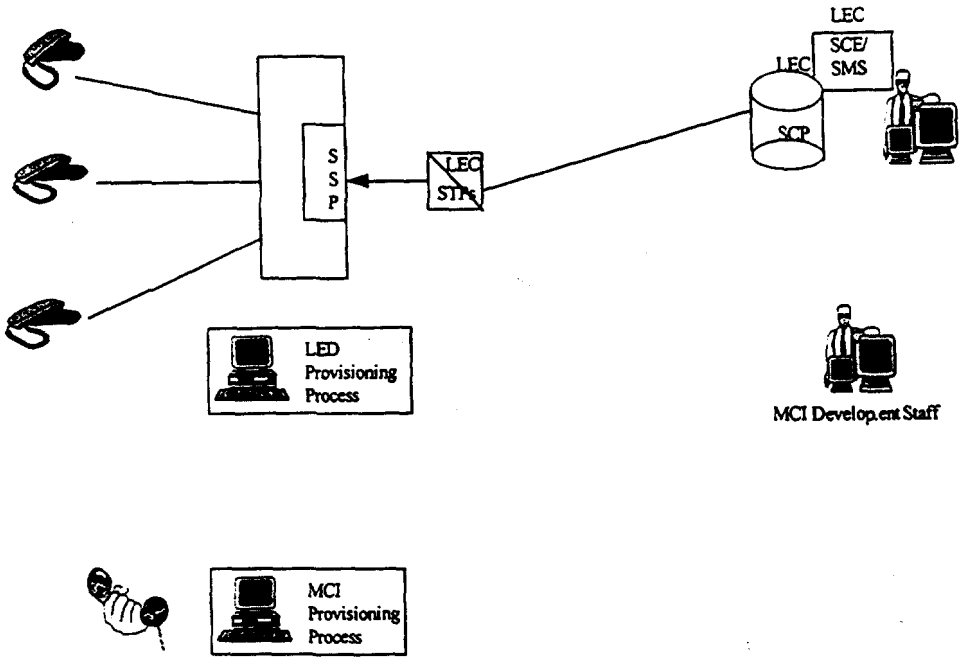

Figure 7

13.8.2 ILEC shall make SCE hardware, software, testing and technical support (e.g., help desk, system administrator) resources available to MCIm. Scheduling of SCE resources shall allow MCIm at least equal priority to ILEC.

13.8.3 The ILEC SCE/SMS shall allow for multi-user access with proper source code management and other logical security functions as specified in the Security section of this Agreement.

13.8.4 The ILEC SCP shall partition and protect MCIm service logic and data from unauthorized access, execution or other types of compromise.

13.8.5 ILEC shall provide training, documentation, and technical support of MCIm development staff in a manner at least at parity with that provided to ILEC's own development staff. Training sessions shall be "suitcased" to MCIm facilities or delivered at ILEC facilities, at MCIm's discretion.

13.8.6 When MCIm selects SCE/SMS AIN Access, ILEC shall provide for a secure, controlled access environment on-site as well as via remote data connections (e.g., dial up, LAN, WAN).

13.8.7 When MCIm selects SCE/SMS AIN Access, ILEC shall allow MCIm to download data forms and/or tables to the ILEC SCP via the ILEC SMS without intervention from ILEC (e.g., service customization and customer subscription).

13.8.8 SCPs/Databases shall offer SCE/SMS AIN Access in accordance with the requirements of: GR-1280-CORE, AIN Service Control Point (SCP) Generic Requirements.

Section 14. Tandem Switching

14.1 Definition:

Tandem Switching is the function that establishes a communications path between two switching offices through a third switching office (the tandem switch) including but not limited to CLEC, ILEC, Independent telephone companies, IXCs and wireless carriers.

14.2 Technical Requirements

14.2.1 Tandem Switching shall have the same capabilities or equivalent capabilities as those described in Bell Communications Research TR-TSY-000540 Issue 2R2, Tandem Supplement, 6/I/90. The requirements for Tandem Switching include, but are not limited to, the following:

14.2.1.1 Tandem Switching shall provide signaling to establish a tandem connection;

14.2.1.2 Tandem Switching shall provide screening and routing as designated by MCIm;

14.2.1.3 Tandem Switching shall provide recording of all billable events designated by MCIm;

14.2.1.4 Tandem Switching shall provide Advanced Intelligent Network triggers supporting AIN features;

14.2.1.5 Tandem Switching shall provide connectivity to Operator Systems as designated by MCIm;

14.2.1.6 Tandem Switching shall provide access to Toll Free number portability database as designated by MCIm;

14.2.1.7 Tandem Switching shall provide all trunk interconnections discussed under the "Network Interconnection" section (e.g., SS7, MF, DTMF, Dial Pulse, PRI-ISDN, DID, and CAMA-ANI (if appropriate for 911));

14.2.1.8 Tandem Switching shall provide connectivity to PSAPs where 911 solutions are deployed and the tandem is used for 911; and

14.2.1.9 Tandem Switching shall provide connectivity to transit traffic to and from other carriers.

14.2.2 Tandem Switching shall accept connections (including the necessary signaling and trunking interconnections) between end offices, other tandems, IECs, ICOs, CAPs and CLEC switches.

14.2.3 Tandem Switching shall provide local tandeming functionality between two end offices including two offices belonging to different CLEC's (e.g., between an MCIm end office and the end office of another CLEC).

14.2.4 Tandem Switching shall preserve CLASS/LASS features and Caller ID as traffic is processed. Additional signaling information and requirements are provided in Section 12.

14.2.5 Tandem Switching shall record billable events and send them to the area billing centers designated by MCIm. Billing requirements are specified in Attachment 8 of this Agreement.

14.2.6 ILEC shall perform routine testing and fault isolation on the underlying switch that is providing Tandem Switching and all its interconnections. When requested by MCIm, the results and reports of the testing shall be made immediately available to MCIm.

14.2.7 When requested by MCIm, ILEC shall provide performance data regarding traffic characteristics or other measurable elements to MCIm for review.

14.2.8 Tandem Switching shall control congestion using capabilities such as Automatic Congestion Control and Network Routing Overflow. Congestion control provided or imposed on MCIm traffic shall be at parity with controls being provided or

imposed on ILEC traffic (e.g., ILEC shall not block MCIm traffic and leave its traffic unaffected or less affected).

14.2.9 Tandem Switching shall route calls to ILEC or MCIm endpoints or platforms (e.g., operator services and PSAPs) on a per call basis as designated by MCIm. Detailed primary and overflow routing plans for all interfaces available within the ILEC switching network shall be mutually agreed to by MCIm and ILEC. Such plans shall meet MCIm requirements for routing calls through the local network.

14.2.10 Tandem Switching shall process originating toll-free traffic received from an MCIm local switch.

14.2.11 In support of AIN triggers and features, Tandem Switching shall provide SSP capabilities when these capabilities are not available from the Local Switching Network Element.

14.2.12 The Local Switching and Tandem Switching functions may be combined in an office. If this is done, both Local Switching and Tandem switching shall provide all of the functionality required of each of those Network Elements in this Agreement.

14.3 **Interface Requirements**

14.3.1 Tandem Switching shall provide interconnection to the E911 PSAP where the underlying Tandem is acting as the E911 Tandem.

14.3.2 Tandem Switching shall interconnect, with direct trunks, to all carriers with which ILEC interconnects.

14.3.3 ILEC shall provide all signaling necessary to provide Tandem Switching with no loss of feature functionality.

14.3.4 Tandem Switching shall interconnect with MCIm's switch, using two-way trunks, for traffic that is transiting via the ILEC network to interLATA or intraLATA carriers. At MCIm's request, Tandem Switching shall record and keep records of traffic for billing.

14.3.5 At MCIm's request, Tandem Switching shall provide overflow routing of traffic from a given trunk group or groups onto another trunk group or groups according to the methodology that MCIm designates.

14.4 Tandem Switching shall meet or exceed (i.e., be more favorable to MCIm) each of the requirements for Tandem Switching set forth in the following technical references:

14.4.1 Bell Communications Research TR-TSY-000540 Issue 2R2, Tandem Supplement, 6/I/90;

14.4.2 GR-905-CORE covering CCSNIS;

14.4.3 GR-1429-CORE for call management features; and GR-2863-CORE and GR-2902-CORE covering CCS AIN interconnection.

Section 15. Additional Requirements

This Section 15 of Attachment III sets forth the additional requirements for unbundled Network Elements which ILEC agrees to offer to MCIm under this Agreement.

15.1 **Cooperative Testing**

15.1.1 **Definition**:

Cooperative Testing means that ILEC shall cooperate with MCIm upon request or as needed to (1) ensure that the Network Elements and Ancillary Functions and additional requirements being provided to MCIm by ILEC are in compliance with the requirements of this Agreement, (2) test the overall functionality of various Network Elements and Ancillary Functions provided by ILEC to MCIm in combination with each other or in combination with other equipment and facilities provided by MCIm or third parties, and (3) ensure that all operational interfaces and processes are in place and functioning properly and efficiently for the provisioning and maintenance of Network Elements and Ancillary Functions and so that all appropriate billing data can be provided to MCIm.

15.1.2 **Requirements**

Within 45 days of the Effective Date of this Agreement, MCIm and ILEC will agree upon a process to resolve technical issues relating to interconnection of MCIm's network to ILEC's network and Network Elements and Ancillary Functions. The agreed upon process shall include procedures for escalating disputes and

unresolved issues up through higher levels of each company's management. If MCIm and ILEC do not reach agreement on such a process within 45 days, any issues that have not been resolved by the parties with respect to such process shall be submitted to the procedures set forth in Part A Section 23 of this Agreement unless both parties agree to extend the time to reach agreement on such issues.

15.1.2.1 ILEC shall provide MCIm access for testing at any interface between a ILEC Network Element or combinations and MCIm equipment or facilities. Such test access shall be sufficient to ensure that the applicable requirements can be tested by MCIm. This access shall be available seven (7) days per week, 24 hours per day.

15.1.2.2 MCIm may test any interfaces, Network Elements or Ancillary Functions and additional requirements provided by ILEC pursuant to this Agreement.

15.1.2.3 ILEC shall provide engineering data as requested by MCIm for the loop components as set forth in Sections 2, 3 and 4 of this Attachment which MCIm may desire to test. Such data shall include equipment engineering and cable specifications, signaling and transmission path data.

15.1.2.4 Upon MCIm's request, ILEC shall provide to MCIm any office records, central office layout and design records and drawings, system engineering and other applicable documentation pertaining to a Network Element or Ancillary Function or the underlying equipment that is then providing a Network Element or Ancillary Function to MCIm.

15.1.2.5 ILEC shall provide to MCIm upon request, all applicable test results, from ILEC testing activities on a Network Element or Ancillary Function or Additional Requirement or the underlying equipment providing a Network Element or Ancillary Function or Additional Requirements. MCIm may review such testing results and may notify ILEC of any deficiencies that are detected.

15.1.2.6 ILEC shall temporarily provision MCIm designated Local Switching features for testing. Within 60 days of the Effective Date of this Agreement, MCIm and ILEC shall mutually agree on the procedures to be established between ILEC and MCIm to expedite such provisioning processes for feature testing.

15.1.2.7 Upon MCIm's request, ILEC shall provide technical staff to meet with MCIm representatives to provide required support for Cooperative Testing.

15.1.2.8 Dedicated Transport and Loop Feeder may experience alarm conditions due to in-progress tests. ILEC shall not remove such facilities from service without obtaining MCIm's prior approval.

15.1.2.9 ILEC shall get acceptance from MCIm prior to conducting tests or maintenance procedures on Network Elements or Ancillary Functions or on the underlying equipment that is then providing a Network Element or Ancillary Function, that may cause a service interruption or degradation of service

15.1.2.10 ILEC shall provide a single point of contact to MCIm that is available 7 days per week, 24 hours per day for trouble status, sectionalization, resolution, escalation, and closure. Such staff shall be adequately skilled to allow expeditious problem resolution.

15.1.2.11 ILEC shall provide to MCIm electronic access to 105 responders, 100-type test lines, or 102-type test lines associated with any circuits under test.

15.1.2.12 ILEC shall participate in Cooperative Testing with MCIm upon MCIm's request to test any operational interface or process used to provide Network Elements, Ancillary Functions or Services to MCIm.

15.1.2.13 MCIm and ILEC shall endeavor to complete Cooperative Testing as stated in Attachment 8.

15.1.2.14 ILEC shall participate in Cooperative Testing requested by MCIm whenever it is deemed necessary by MCIm to insure service performance, reliability and customer serviceability.

15.1.2.15 MCIm may accept or reject the Network Element ordered by MCIm if, upon completion of cooperative acceptance testing, the tested Network Element does not meet the requirements stated herein.

15.2 Performance

15.2.1 Scope

This section addresses performance requirements for Network Elements and Ancillary Functions to provide local service. It includes requirements for the reliability and availability of Network Elements and Ancillary Functions, and quality parameters such as transmission quality (analog and digital), and speed (or delay). In addition, an overview of service performance requirements is given.

15.2.1.1 The General Performance Requirements in this section apply to all aspects of Network Elements and Ancillary Functions. Additional requirements are given in this performance section and in the individual Network Elements sections.

15.2.1.2 ILEC shall work cooperatively with MCIm to determine appropriate performance allocations across Network Elements.

15.2.2 ILEC shall provide real-time, remote data access to performance monitoring and alarm data on events affecting (or potentially affecting) MCIm's traffic.

15.2.3 ILEC shall provide performance equal to or better than all of the requirements set forth in the following technical references:

15.2.3.1 **Bell Communications Research, Inc. Documents**

15.2.3.1.1 FR-64, *LATA Switching Systems Generic Requirements (LSSGR).* This document contains 117 Technical References and Generic Requirements. Sections provide the requirements for local switching systems (also referred to as end offices) that serve customers' lines. Some modules of the LSSGR are also referenced separately in this document.

15.2.3.1.2 TR-NWT-000499, Issue 5, Rev 1, April 1992, *Transport Systems Generic Requirements (TSGR): Common Requirements.*

15.2.3.1.3 TR-NWT-000418, Issue 2, December 1992, *Generic Reliability Assurance Requirements For Fiber Optic Transport Systems.*

15.2.3.1.4 TR-NWT-000057, Issue 2, January 1993, *Functional Criteria for Digital Loop Carriers Systems.*

15.2.3.1.5 TR-NWT-000507, Issue 5, December 1993, *LSSGR - Transmission, Section 7.*

15.2.3.1.6 GR-303-CORE, Issue 1, September 1995, *Integrated Digital Loop Carrier System Generic Requirements, Objectives, and Interface.*

15.2.3.1.7 GR-334-CORE, Issue 1, June 1994, *Switched Access Service: Transmission Parameter Limits and Interface Combinations.*

15.2.3.1.8 TR-NWT-000335, Issue 3, May 1993, *Voice Grade Special Access Services - Transmission Parameter Limits and Interface Combinations.*

15.2.3.1.9 TR-TSY-000529, Issue 2, July 1987, *Public Safety - LSSGR.*

15.2.3.1.10 GR-1158-CORE, Issue 2, October 1995, *OSSGR Section 22.3: Line Information Database.*

15.2.3.1.11 TR-TSY-000511, Issue 2, July 1987, *Service Standards, a Module (Section 11) of LATA Switching Systems Generic Requirements (LSSGR, FR-NWT-000064).*

15.2.3.1.12 TR-NWT-000393, January 1991, *Generic Requirements for ISDN Basic Access Digital Subscriber Lines.*

15.2.3.1.13 TR-NWT-000909, December 1991, *Generic Requirements and Objectives for Fiber In The Loop Systems.*

15.2.3.1.14 TR-NWT-000505, Issue 3, May 1991, *LSSGR Section 5, Call Processing.*

15.2.3.1.15 FR-NWT-000271, 1993, *Operator Services Systems Generic Requirements (OSSGR).*

15.2.3.1.16 TR-NWT-001156, Issue 2, July 1993, *OSSGR Operator Services Systems Generic Requirements, Section 21, Operator Subsystem.*

15.2.3.1.17 SR-TSY-001 171, Issue 1, January 1989, *Methods and Procedures for System Reliability Analysis.*

15.2.3.1.18 Bellcore *Telecommunications Transmission Engineering,* 3rd Ed, 1990.

15.2.3.2 **ANSI Standards**

15.2.3.2.1 ANSI T1.512-1994, Network Performance - Point-to-Point Voice-Grade Special Access Network Voiceband Data Transmission Objectives.

15.2.3.2.2 ANSI T1.506-1990, Network Performance - Transmission Specifications for Switched Exchange Access Network.

15.2.3.2.3 ANSI T1.508-1992, Telecommunications - Network Performance - Loss Plan for Evolving Digital Networks. Also supplement T1.508a-1993.

15.2.3.2.4 ANSI T1.101-1994, Digital Synchronization Network Plan.

15.2.3.3 **TIA/EIA Standards**

15.2.3.3.1 Requirements not specifically addressed here shall be found in the documents listed in Electronic Industries Association/Telecommunications Industries Association Standards and Engineering Publications.

15.2.3.3.2 TIA/EIA TSB-37A, Telephone Network Transmission Model for Evaluating Modem Performance.

15.2.3.3.3 TIA/EIA TSB-38, Test Procedure for Evaluation of 2-wire 4 kHz Voiceband Duplex Modems.

15.2.3.4 **IEEE Standards**

15.2.3.4.1 IEEE Standard 743-1984, IEEE Standard Methods and Equipment for Measuring Transmission Characteristics of Analog Voice Frequency Circuits.

15.2.3.4.2 ANSI/IEEE Standard 820-1984, Telephone Loop Performance Characteristics.

15.2.4 Services and Capabilities

15.2.4.1 All Network Elements shall provide performance sufficient, in combination with other Network Elements, to provide the following applications in accordance with the requirements of this document:

15.2.4.1.1 All types of voice services.

15.2.4.1.2 All types of voice-band data modem connections up to and including 28.8 Kbps V-34.

15.2.4.1.3 All types of FAX transmissions up to and including 14.4 Kbps group 3.

15.2.4.1.4 All CLASS/LASS features.

15.2.4.1.5 All Operator Systems.

15.2.4.2 The following capabilities shall be provided as applicable:

15.2.4.2.1 ISDN BRI

15.2.4.2.2 ISDN PRI

15.2.4.2.3 Switched Digital Data

15.2.4.2.4 Non-Switched Digital Data

15.2.4.2.5 Any types of Video applications that a customer may order

15.2.4.2.6 Any Coin Services the customer may order

15.2.4.2.7 Frame Relay and ATM

15.2.4.2.8 Private Line Services

15.2.5 Specific Performance Requirements for Network Elements and Ancillary Functions

15.2.5.1 The following sections itemize performance parameters for Network Elements and Ancillary Functions. ILEC shall provide performance equal to or better than all of the requirements set forth in this Section. Unless noted otherwise, requirements and objectives are given in terms of specific limits. This means that all tests (acceptance and ongoing performance) shall meet the limit(s) to satisfy the requirement.

15.2.5.2 **Performance Allocation**

15.2.5.2.1 Transmission path impairments may be classified as either analog or digital, and will depend on the nature of the signal transmitted across the Network Element. Analog impairments are introduced on any analog portion of the loop, typically between the NID portion of Loop Distribution and the analog to digital (A/D) conversion, and are usually correlated with the length of the physical plant. Digital impairments are introduced by A/D conversion and by interfaces between digital Network Elements. In addition, noise can be introduced by either analog transmission or the A/D conversion.

15.2.5.3 **Loop Combination Architecture Constraints**

15.2.5.3.1 The following constraints will limit not only the variety of Loop Combination architectures that may be considered, but also the architectures ILEC may consider to deliver any Ancillary Function or Network Element. These constraints apply to the entire path between the NID portion of Loop Distribution and the ILEC switch. Any exceptions to these restrictions shall be specifically requested or approved by MCIm in writing.

15.2.5.3.1.1 No more than 1 A-D conversion.

15.2.5.3.1.2 No more than 1, 2-to-4-wire hybrid.

15.2.5.3.1.3 No voice compression.

15.2.5.3.1.4 No echo canceled or suppressers.

15.2.5.3.1.5 One digital loss pad per PBX.

15.2.5.3.1.6 No digital gain.

15.2.5.3.1.7 No additional equipment that might significantly increase intermodulation distortion.

15.2.5.4 **Transmission Impairments**

15.2.5.4.1 **Analog Impairments**

15.2.5.4.1.1 Analog impairments are those introduced on portions of the end-to-end circuit on which communications signals are transmitted in analog format. These portions of the transmission path would typically be between NID and an A/D conversion, most commonly on the metallic loop. The performance on the analog portion of a circuit is typically inversely proportional to the length of that circuit.

15.2.5.4.1.2 **Loss**

15.2.5.4.1.2.1 Electrical loss is measured using a 1004 Hz 0.0 DB one Milliwatt 900 ohm test tone.

15.2.5.4.1.2.2 Off-hook electrical loss between the NID and the switch shall be no more than 8.0 dB for any line, and the mean value for all lines shall be 3.5 dB ±0.5 dB. On-hook electrical loss between the NID and the switch shall be no more than 4.0 dB above the off-hook electrical loss for any line.

15.2.5.4.1.3 **Idle Channel Circuit Noise**

15.2.5.4.1.3.1 Idle channel circuit noise (C-message) is added by analog facilities, by the A/D conversion of signals, by digital processing equipment (e.g., echo cancelers, digital loss pads), robbed bit signaling, and errors on digital facilities.

15.2.5.4.1.3.2 Idle channel circuit noise shall be less than or equal to 18 dBrnC.

15.2.5.4.1.4 **Talker Echo**

15.2.5.4.1.4.1 The primary source of echo is improper impedance-matching at the 2-to-4 wire hybrid in the ILEC network. The impact on customer perception is a function of both echo return loss and delay.

15.2.5.4.1.4.2 Echo Return Loss (ERL) shall be greater than 26 dB to a standard termination (900 ohms, 2.16 μFd), and greater than 14 dB to a telephone set off-hook. Singing Return Loss (SRL) shall be greater than 2l dB to a standard termination, and greater than 11 dB to a telephone set off-hook.

15.2.5.4.1.5 **Listener Echo**

Listener echo is a double reflection of a transmitted signal at two different impedance mismatches in the end-to-end connection. While in extreme cases it can degrade voice transmission performance, listener echo is primarily an issue for voiceband data. The requirements on Talker Echo shall apply to Listener Echo.

15.2.5.4.1.6 **Propagation and Processing Delay**

15.2.5.4.1.6.1 Propagation delay is the delay involved in transmitting information from one

location to another. It is caused by processing delays of equipment in the network and delays associated with traveling across transmission facilities.

15.2.5.4.1.6.2 ILEC shall cooperate with MCIm to limit total service propagation and processing delay to levels at parity with that within the ILEC local network.

15.2.5.4.1.7 **Signal-to-Noise Ratio**

15.2.5.4.1.7.1 The Signal-to-Noise Ratio (S/N) is a critical parameter in determining voiceband data performance. It is typically measured with a 1004 Hz tone.

15.2.5.4.1.7.2 ILEC must provide on the Loop Combination a signal-to-noise ratio of at least 37 dB between the NID and the end office.

15.2.5.4.1.8 **C-Notched Noise**

The requirements for Signal-to-Noise Ratio shall apply to C-Notched Noise.

15.2.5.4.1.9 **Attenuation Distortion**

15.2.5.4.1.9.1 Attenuation distortion, also known as frequency distortion or gain slope, measures the variations in loss at different frequencies across the voice frequency spectrum (200 Hz - 3400 Hz). It is measured by subtracting the loss at 1004 Hz from the loss at the frequency of interest.

15.2.5.4.1.9.2 Attenuation distortion from the NID to the switch shall be within the range ±0.5 dB for frequencies between 304 and 3004 Hz; from the switch to NID attenuation distortion shall be within the range ±0.5 dB for frequencies between 204 Hz and 3004 Hz. In addition, attenuation distortion shall remain

within the range +1 dB/-3 dB for frequencies between 200 Hz and 3500 Hz.

15.2.5.4.1.10 **Envelope Delay Distortion**

15.2.5.4.1.10.1 Envelope Delay Distortion (EDD) measures the difference in transit time of signals at different frequencies. EDD is measured relative to the transit time of a 1704 Hz tone, and is given in microseconds. EDD is used as an approximation of the group delay of the channel.

15.2.5.4.1.10.2 EDD shall be: 1704 Hz to 604 Hz — ≤ 350 μsec.; 1704 Hz to 2804 Hz — ≤ 195 μsec.; 1704 Hz to 204 Hz — ≤ 580 μsec.; 1704 Hz to 3404 Hz — ≤ 400 μsec.

15.2.5.4.1.11 **Phase Jitter**

15.2.5.4.1.11.1 Phase jitter measures the unwanted angular modulation of a signal. It is caused by noise or the actual modulation of the signal by another unwanted signal. It displaces the zero crossings of a signal. It is measured in terms of peak-to-peak deviations of a 1004 Hz tone from its nominal zero crossings, and in a particular frequency band (200-300 HZ and either 4-300 Hz or 2-300 Hz). Phase jitter impacts voiceband data performance and can make modems more susceptible to other impairments, including noise.

15.2.5.4.1.11.2 From the NID to the interexchange carrier point of termination, phase jitter shall be < 1.5° point-to-point in the 0-300 Hz band, and
< 1.8° point-to-point in the 4-300 Hz band.

15.2.5.4.1.12 **Amplitude Jitter**

15.2.5.4.1.12.1 Amplitude jitter is any deviation of the peak value of a 1004 Hz signal

from its nominal value. Excessive amounts can impair voiceband data performance. It is primarily caused by noise but can also be caused by phase jitter, gain hits, or single frequency interference.

15.2.5.4.1.12.2 In NID-interexchange carrier point of termination, ≤ 2.5% of amplitude jitter is permitted in the 20-300 Hz band and ≤ 2.9% in the 4-300 Hz band.

15.2.5.4.1.13 **Intermodulation Distortion**

15.2.5.4.1.13.1 Intermodulation distortion (IMD) measures non-linear distortions of a signal. It compares the power of harmonic tones to the power of the transmitted tones. It is measured for both the 2nd and 3rd harmonics of the transmitted tones. IMD is caused by compression or clipping and can impair voiceband data performance.

15.2.5.4.1.13.2 Both 2nd and 3rd order IMD between the NID and end office must be ≥ 52 dB.

15.2.5.4.1.14 **Impulse Noise**

15.2.5.4.1.14.1 Impulse noise is a sudden and large increase in noise on a channel for a short duration of time. Impulse noise is measured as a count of the number of times a noise threshold is exceeded during a given time period (typically 5 or 15 minutes). It is caused by protection switching, maintenance activities, electromechanical switching systems, digital transmission errors, and line coding mismatches. Impulse noise sounds like clicking noises or static on voice connections. Impulse noise impairs voiceband data performance.

15.2.5.4.1.14.2 The NID to interexchange carrier point of termination portions of connections shall introduce no impulse noise events within 6 dB of the received signal power

on 93% of all 15 minute connections. In addition, there shall be no more than 1 impulse noise event within 6 dB of the received signal power during any 30-minute period.

15.2.5.4.1.15 **Phase Hits**

15.2.5.4.1.15.1 Phase hits are a sudden change in the phase of a signal lasting at least 4 msec. Phase hits are measured using a threshold which indicates how much the phase of the signal has changed with respect to its nominal phase. Phase hits are caused by protection switching and slips or other synchronization errors. Phase hits can impair voiceband data performance.

15.2.5.4.1.15.2 Between the NID and interexchange carrier point of termination, 99.75% of all 15-minute connections shall have no phase hits exceeding 10°. In addition, there shall be no more than 1 phase hit exceeding 10° in any 30-minute period.

15.2.5.4.1.16 **Gain Hits**

15.2.5.4.1.16.1 Gain hits are sudden changes in the level of a signal that last at least 4 msec. Gain hits are measured against a threshold of typically 2-5 dB relative to the signal's nominal level. Gain hits are usually caused by protection switches and can impair voiceband data performance.

15.2.5.4.1.16.2 Between the NID and the interexchange carrier point of termination, 99.5% of all 15-minute connections shall have no gain hits exceeding 3 dB. In addition, there shall be no more than 1 gain hit exceeding 3 dB in any 30-minute period.

15.2.5.4.1.17 **Dropouts**

15.2.5.4.1.17.1 Dropouts are drops in the level of a signal of 12 dB or more for at least 4

msec. They are caused by protection switching events, radio fading, and conditions causing digital carrier systems to lose frame. Dropouts are critical for voiceband data performance but, if severe enough, will also affect voice quality.

15.2.5.4.1.17.2 Between the NID and the interexchange carrier point of termination, 99.9% of all 15-minute connections shall have no dropouts and in addition, no connection shall suffer more than 1 dropout in any 60-minute period.

15.2.5.4.1.18 **Frequency Shift**

15.2.5.4.1.18.1 Frequency shift measures any frequency changes that occur when a signal is transmitted across a channel. It is typically measured using a 1004 Hz tone. Frequency shift has very little impact on voice or voiceband data performance; however, round-trip frequency shifts can affect the ability of echo cancelers to remain converged.

15.2.5.4.1.18.2 No more than 0.2 Hz frequency shift shall be on any connection. In addition, 99.5% of all calls shall have frequency shift < 0.1 Hz.

15.2.5.4.1.19 **Crosstalk**

15.2.5.4.1.19.1 Crosstalk is the presence of signals from other telephone connections on a circuit. Crosstalk can be either intelligible, when speech from other connections can be heard and understood, or unintelligible. Crosstalk is caused by inter-channel interference on the transmission system. Crosstalk is difficult to measure: it requires correlating signals on different circuits or using human listeners to identify its presence. Trouble reports may be used to estimate the probability of crosstalk.

15.2.5.4.1.19.2 99% of Loop Combinations shall have probability ≤ 0.1% of experiencing crosstalk exceeding -65 dBm0.

15.2.5.4.1.20 **Clipping**

15.2.5.4.1.20.1 Clipping occurs when part of a transmitted signal is dropped and does not reach the receiving portion on a connection. It can be caused by Digital Speech Interpolation (DSI) equipment used in Digital Circuit Multiplication Systems (DCMS) which increase the amount of traffic that transmission facilities carry, and by echo cancelers or echo suppressers.

15.2.5.4.1.20.2 No clipping incidents shall occur on any call.

15.2.5.4.2 **Digital Impairments**

Digital impairments occur in the signal wherever it is transmitted in digital format. These errors are usually introduced upon conversion of the signal from analog to digital, as well as at interfaces between digital components. While many digital impairments have little impact on subjective voice quality, they can impact voiceband data performance.

15.2.5.4.2.1 **Signal Correlated Distortion**

15.2.5.4.2.1.1 Signal correlated distortion (SCD) is unwanted noise or distortion introduced into a signal through the conversion of a signal from analog to digital format or through digital processing that changes the transmitted signal. SCD affects performance when a sign is being transmitted. The primary sources of SCD are signal encoders, echo cancelers, digital loss pads, and robbed bit signaling. SCD affects both voice and voiceband data performance.

15.2.5.4.2.1.2 The NID-to-end-office connection shall allow:

15.2.5.4.2.1.2.1 A maximum of 1 A/D conversion, using 64 Kbps μ-law (μ=255) PCM;

15.2.5.4.2.1.2.2 No voice compression;

15.2.5.4.2.1.2.3 No echo cancellation; and

15.2.5.4.2.1.2.4 Robbed bit signaling only if SS7 or ISDN are not used.

15.2.5.4.2.2 **Slips**

15.2.5.4.2.2.1 Slips occur when a frame of digital data is either deleted or repeated because of differences in the clocks used to synchronize digital facilities. Slips sound like clicks or pops on voice calls and have major impact on voiceband data performance.

15.2.5.4.2.2.2 The NID-to-interexchange carrier point of termination portion of connections shall have fewer than 0.45 slips every 24 hours on average.

15.2.5.4.2.3 **Digital Timing Jitter and Wander**

15.2.5.4.2.3.1 Digital timing jitter is the unwanted phase modulation of digital signals at rates above 10 Hz. Wander is the unwanted phase modulation of digital signals at rates below 10 Hz. Digital timing jitter is caused by imperfections in the timing recovery process of repeaters and the stuffing synchronization process used by multiplexer/demultiplexers. Wander is caused by slowly varying changes in digital signal phase due to clock frequency offset and drift, changes in propagation delay of terrestrial facilities due to temperature changes and changes in the distance of